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Special Issue—Time Study and Methods Conference

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A Charge for the Future

WHAT IS IT that makes a successful organization? There is no single answer to this question, but there are a number of factors which contribute to the success of an organization.

There must be a worthwhile purpose stated in the form of objectives which are known and understood by all. These objectives must provide a banner around which the members of the organization can rally and believe that in promoting these objectives they are making a contribution to something worth while.

The organization must have high ideals. Its program and methods must be on a high ethical plane, one in which every member of the organization can take just pride.

The policies of the organization must recognize and reflect the quality of the purposes and objectives and the high ethical concepts of the organization.

The structure of the organization must be carefully planned to permit the accomplishment of the stated purposes within the policy limits prescribed.

The meeting of the foregoing conditions is prerequisite to organizational success. Following their attainment, it becomes the problem of management to insure the accomplishment (on schedule) of the organization objectives, in the development of which they participated either directly or indirectly through decisions and recommendations.

The manager must be a true professional. As a member of the profession he must have broad training and experience; a high ethical concept; an interest in his work other than a monetary interest; and a desire to be of service to others. The final test of a profession which the manager meets lies in the fact that his failure to adequately perform the functions involved can deter the organization from objective attainment and conversely his effective performance of the management functions can go far to insure objective attainment. In fact, in this country of ours today the effectiveness of the professional managers will determine to a large extent the acceptance of our American Enterprise system and whether or not the values of this system are to be retained or the whole system thrown over bit by bit for some form of Socialism or Communism, both of which have been tried numerous times and found wanting (by our standards) in each trial.

THIS IS A GREAT responsibility which the professional manager assumes. Success in the discharge of his responsibility implies scientific management. It implies careful planning. He must look ahead, devise a course of action, and make the necessary preparations in advance. If he is to be successful, he must be able to anticipate problems before they arise and either provide for their prompt solution or actually forestall their occurrence. Then he must organize for the accomplishment of the plan. If he is to be a good organizer his first concern must be to organize his own thinking. He must get his own mind and house in order. This means that he must know and accept the objectives, policies and practices of the organization of which he is a part. He must see that all of those who are associated with him are fully informed on company policies, and then within his own sphere of responsibility and authority, he must establish definite lines of authority and responsibility, in such a way as to develop self reliance on the part of each individual in the group. Finally he must develop controls to insure the accomplishment of the plan. Control under scientific management means the maintenance of records to permit checking of performance against standards, keeping current information on accomplishment under the plan, and evaluating each employee under the plan. Control if it is to be effective, implies that accomplishment must be measured, the score recorded, and reward provided.

Good management will make possible the creation of the conditions requisite to sound organization morale, which is in itself basic to objective attainment. Morale is that condition of organization which causes each individual to subordinate his own personal objectives willingly to those of the organization, because of his interest in and devotion to the "cause" which is the prime mover for the entire organization and the attainment of which will eventually result in greater benefits to those who have contributed. The development of morale is the responsibility of the manager and his leadership problem is made easier through its development as less friction results and he is able to build a team of the individuals who work directly with him in the organization.

While the high standard of living which we enjoy today has resulted from technological advances aided and abetted by new and improved methods and techniques, the contribution which is to be made today, while continuing our technological research for the future, is in the broad field of management. This implies, as Frederick Taylor stated at the turn of the century, full and continued consideration of the individual—of human relationships. This is the purpose to which our Society is dedicated, this is the field for our accomplishment, this is our charge for the future.

DILLARD E. BIRD

Work Psychology and Time and Motion Study

By JAMES J. GILLESPIE

Author, "Dynamic Motion and Time Study" and "Human Values, Work and Organization"

Investigation into the psychodynamics of work reveals important phases of "willingness" and "interest reduction" to be considered in the application of modern techniques.

THE APPLICATION OF motion and time study and attendant techniques raises many problems, and of these, work aversion and boredom are important. Because work aversion and boredom are important, their antagonist, work interest, is also important for, as we have said earlier, where there is interest, there is neither aversion nor boredom. In work, most individuals are interested in the money gain from work and interest in the work itself is often a negligible quantity. Unfortunately, we have been concerned more with the economic than with the psychological aspects of the work act; true, we have books on what is called "industrial psychology," but none of these, so far as I can gather, attempts to explain the work act in psychological terms.

The outer, economic function of work, to produce wealth, is well known; but what function has work in the growth of the person? What is its inner, psychological function? Free play, say Read,[21] Lowenfield[44] and Isaacs,[45] is a necessary activity for balanced physical, emotional, and mental personality. But what of work? Is free work necessary for balanced adult personality? Here the modern, analytical psychologist is not of much help to us, for while we can find books on the psychology of play, sex, clothes, laughter, aggression, society, relationships, and what not, there is no book on the psychology of the activity which takes up half our waking life and on which modern civilization is built. Indeed, careful scrutiny of fifty books on psychology and a large number of journals showed only one reference to work psychodynamics, and in this, the doctor writer remarks on the poverty of modern analytical psychology and its care for bits of people rather than for people as whole, active organisms.[46]

In *Human Values, Work and Organization,* the work situation is analyzed, the relationship of work activity to play activity and rest is shown, and a plan for industry is advanced.[41] Here we can mention the matter only in relation to the decreasing freedom and responsibility of people in work as planning and motion-study techniques increase in application.

Adapted from Chapter 16 of the manuscript *"Dynamic Motion and Time Study,"* by James J. Gillespie, by permission of the publishers, Chemical Publishing Co., Inc.

WORK PSYCHODYNAMICS

The founders of modern, curative psychology, Freud and Jung, have this to say of work. Quoting from Freud:

> It is not possible to discuss the significance of work for the economics of the libido (life force J.J.G.) adequately within the limits of a short survey. Laying stress upon the importance of work has a greater effect than any other technique of living in the direction of binding the individual more closely to reality. . . . Work is no less valuable for the opportunity it and the human relations connected with it provide for a very considerable discharge of libidinal component impulses, narcissistic, aggressive and even erotic, than because it is indispensable for subsistence and justifies existence in society. The daily work of earning a livelihood affords particular satisfaction when it has been selected by free choice, i.e., when through sublimation, it enables use to be made of existing inclinations, of instinctual impulses that have retained their strength, or are more intense than usual for constitutional reasons.[48]

Jung goes farther into the value of work as an expression of man increasingly mastering the outer world as libido (life force), increasingly expresses its creativeness. He agrees with Freud in stressing the psychological value of work activity and, too, warns us against regression to infantile, primitive states when free, regular work is not done. From regression, he says:

> The best liberation is through regular work. Work, however, is salvation only when it is a free act and has in itself nothing of infantile compulsion.[49]

The contribution of Adler, the founder of individual psychology, is not based on libido theory but is based, rather, on will-to-power which, for our purpose, can be reasonably allied to Freud's and Jung's interpretations of life force. Adler repeats the words of Freud and Jung in his psychology, though with a different outlook on personal and group psychodynamics:

> By willingness to work, we mean the willingness to do as much as you can. The approach to a task is a giving-out-of-oneself which only one who believes in himself, and in his ability to accomplish something, will attempt.[50]

THE VALUES OF WORK

Although the Adler school believes also in free work, work willingly done, we shall direct our attention to Freud and Jung. What these two great psychologists mean, in nontechnical terms, is

that it is work in which there is free personal interest (libido) that is valuable psychologically and socially and, they tell us that work which is not freely done will lead to regression if there are no compensating, equally good channels for interest expenditure. That lack of work does lead to regression to primitive states is well evidenced by study of unemployed people and that regimented, unfree work increases boredom and apathy (regressive symptoms) as well as escape into illness is becoming increasingly clear.[47] But the reaction to frustration is not always regression; it is first of all aggression, fight against the frustrating situation in one or other form. Alas, we have not yet studied aggressiveness among workers as a right reaction to frustration in work, but are content to call aggressive conduct a form of neurosis when, in fact, it may well be a conscious or unconscious striving for psychological expression in the face of economic frustration.

Work, as is stated in our principle of work activity, is man's effort to manipulate the outer world in response to inner need and in it, the adult person should find ego significance in community, satisfaction of his desire to mold and master the environment, work pleasure, and an opportunity to maintain and grow beyond the existing civilized status. Work in community, as is pointed out in *Human Values, Work and Organization*, has yet higher values, growth of caring and sympathy for others and healing emotional support of common group effort, but these we cannot fully discuss here. It is worth noting, however, that the psychologist, Dr. Fromm, points out in his analysis of our social condition that it is through love and productive work that man will find salvation,[51] that is, through work in and for the community.

The therapeutic value of free play and free art is well proved in school and hospital, but the therapy of free work has yet to be stated in modern terms. In *Regeneration through Art*, Maria Petrie points out the regenerative effects gained from free occupational therapy as well as from free play and art,[52] but it has not yet been shown clearly that while play is a form of art when play is free,[38] work is also a form of art when work is free and has the spontaneous quality of art. Work, play and rest are three sides of a balanced triangle, the base of which is rest, and the two sides of which are free play and free work rising to the apex at which is art.

Looking through the pages of my book on motion and time study, it will be seen by all clear-thinking persons that although we have rejected the dangerous atomistic techniques of micromotionism, the motion-study technique (I include planning techniques which find expression on the job in motion and time study) does definitely reduce operator significance, decreases operator responsibility for and at the job, aims to eliminate operator conscious thought about and at the operation, tends to limit and standardize operator movement, and makes the task interest empty. That this frustration is a fact is shown by the wide use of such escapist techniques as "music-while-you-work" by which the worker can be amused and beguiled while doing his or her automatic task. I do not indict music-while-you-work in itself, but I do say that it is a typical avoiding technique which avoids facing the real problem in work: lack of work interest.

In much the same way, the problem of lack of the worker's feeling of responsibility in and for the work is met by joint committees and councils of various sorts in which a worker appointed representative attends periodical meetings while the rest of the workers are spectators and do not actively participate. The solution to our problems in work, in my opinion, is in the direction of increasing active, responsible participation in work-situation affairs by every single person who works; in other words, the new incentive is *shared responsibility* for work by all those who work; active *democratic participation.* Many of us say that the modern worker is irresponsible, but how can we expect responsible attitudes and acts from people whom we treat, in fact, as irresponsible? Does not the modern work situation, unlike the craft-work situation, take away worker responsibility and put it in the hands of specialists and eliminate the interest flow and the freedom of movement in the doing of handicraft and craft work? If Freud and Jung are right when they speak of the high psychological value of and the social necessity for free work, then, indeed, we are running industry in a dangerously unbalanced fashion. I should like to prove here that free work means more and better work, but lacking the space necessary for this argument, I must refer the reader to another book.[47]

MORALE AND MOTION STUDY

We accept the economic necessity for effective organizing techniques, but we accept more definitely the psychological necessity for free expression in and through work. How can we, if at all, express both needs in an effective fashion?

In the first place, the disciplines inherent in organized work need not be imposed entirely by external authority (military discipline), but can be imposed by the working person and the working group on themselves (morale discipline). That a group of ordinary persons who are free will work and impose their own disciplines is well evidenced in the work of Lewin, the British Army psychiatrists, Moreno, Bion and Rickman, Wills and others[47] but, it will be argued, the ordinary worker is incapable of accepting responsibility. I think we should at this point ponder that fact that in our culture the roles of a person are split into that of citizen and that of worker, and that in the first role, he is an increasingly responsible person while, in the second role, he is treated as a decreasingly responsible person; in the first, he has a responsible vote and responsibility for working for and bringing up his family in a home for which his wife takes the responsibility as planner and organizer, and, in the second, he is increasingly planned and time studied by experts. This problem of split roles, a serious one, is wrapped up with the problem of free expression in work.

In industry, dependence for work incentives has been on money appeals and threat of the sack; now, with full employment guarantees and social security measures, these incentives are of decreasing value. I believe the new incentive, one which is psychologically and socially sound, is increased responsibility for and in work.

The attainment of free personal expression in work will, in my opinion, be manifested in increasing worker participation in discussion on and decision about local work-situation affairs, rang-

ing from welfare matters to output methods and quantities. This manifestation of shared responsibility will, in my opinion, gradually alter the modern foreman and supervisor function and make it more exclusively technical and concerned with organizing techniques, and that work disciplines at present imposed by management will be increasingly morale, imposed by the working groups and the working group morale leader. This state cannot be attained at one jump, and the idea should be piloted and proved in those factories where planning and motion-study techniques are well advanced. In other words, the morale function will gradually take its rightful place alongside other business functions in the management hierarchy; in this, the object is not worker control of industry; this we can leave to our political democracy, the idea is the worker's responsible participation in work.[47]

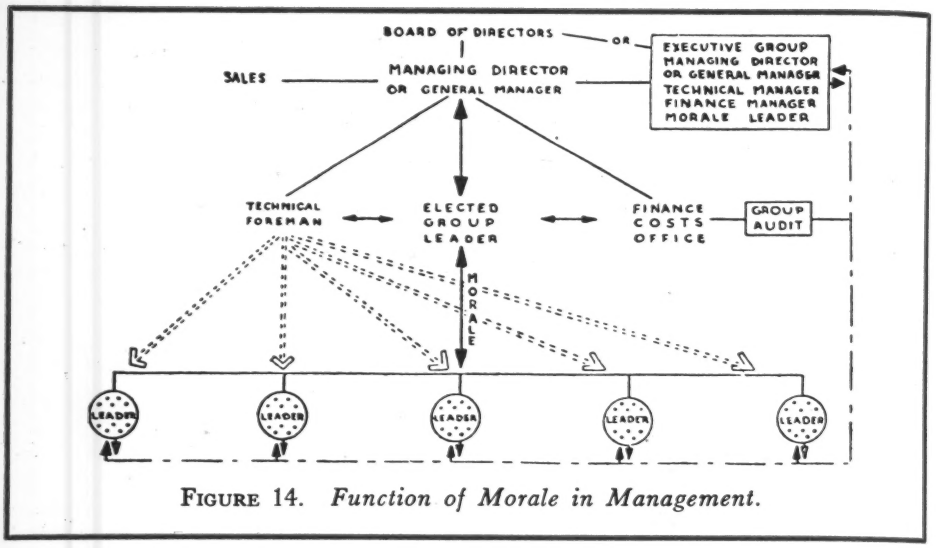

FIGURE 14. *Function of Morale in Management.*

SHARED RESPONSIBILITY

The small chart of Figure 14 is from *Human Values, Work and Organization* and it follows the expression of a morale function in a small works. The morale function is expressed when the working group shows its interest in the work situation by appointing a morale leader who is accepted freely into the actual management organization. The technical function is represented by a fully trained technical foreman. In this scheme, the foreman's function is broken into two functions, technical and morale; the foreman is appointed by the institution and the morale leader by the group. There is a technical foreman and a morale leader for each fifty or sixty employees. It will be remembered that Taylor split foremanship into four or five different functions, each carried out by a special functionary; here we split foremanship into two functions but, unlike Taylor, make one of these a true morale function.

My experience of this kind of organization is necessarily limited but is sufficient to justify thorough research. A profit-sharing scheme is run with morale management and the morale leader takes responsibility for output quantity and discipline. A group audit is used to inform groups of output progress. It will be noted from the chart that each small group (of about ten people) has a leader; this is a working, on-the-job leader.

Less revolutionary than this scheme is the idea of worker group leaders setting job-time rates. This I have often introduced with great success.

In one recent case, where the worker group was opposed to time study, the group agreed to appoint a representative to time jobs. This was done and the results were better than we could have had by imposing rates. One thought-provoking instance was of a tough guy who used to harry the rate-fixers for more time on his press operation. I allowed him to set his own time and, after some doubts, he set a rate some 15% lower than I would have set. I pointed out that he had taken no fatigue allowance and his reply, in effect, was: "you only need fatigue allowance on this kind of job if somebody else tells you what to do; when you tell yourself what to do, there's no fatigue, see."

I do not suggest that one should rush the idea of full worker participation in job time-fixing. I merely put before you an example from my own experience. Note that it is not suggested that worker-group leaders do motion study but only rate fixing.

We cannot deal here fully with the problem of positive generation of work interest and, indeed, what has been suggested is of provocative rather than of actual value. The tendency may be to accept the latest findings in motion and time study and ignore the problems arising from their application, i.e., the problems of movement, skill, and interest reduction in the work situation. I think we shall ignore them to our cost.

Dynamic Motion and Time Study by J. J. Gillespie, will be published in the United States by Chemical Publishing Co., Inc., 212 Fifth Avenue, New York 10, New York, 140 pages, $3.75. Orders may be placed with ADVANCED MANAGEMENT, 84 William Street, New York 38, New York.

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New Frontiers for the Industrial Engineer

By HARRY L. WYLIE

Assistant Secretary-Treasurer, The Pure Oil Company; and
Department of Industrial Management, Northwestern University

An analytical survey of the office "gold mine" that awaits engineers with the right approach and the scientific method.

THE FRONTIER of industrial or plant management is by no means closed. The great progress in scientific management during the past 60 to 70 years as applied to plant layout, construction and design, material handling, development of specialization, establishment of standards, progress in motion economy and work simplification are but a few of the really great contributions of the industrial engineer. However, there is yet to be solved the problem of *human relations*. The frontier will be closed and that phase of the chapter of progress will be concluded when we can measure equal progress in handling the human relations problem as has been made in handling the physical and more tangible problems of industry.

SCIENTIFIC MANAGEMENT IN THE OFFICE

The late William Henry Leffingwell introduced the principles and practices of scientific management to the office some 30 years ago. Although progress since that date has been astonishingly great, comparatively, that progress has been insignificant in relationship to what can and will be done. This brings to the front the great new frontier of office operations which lies before the industrial engineer. In developing this frontier, the industrial engineer is going to confront some rather serious obstacles. For example, he is going to come up against *inertia to change*. Traditional methods have been followed by many companies for 2 and 3 decades with very little variation. Any attempt to streamline and simplify is met by a pronounced defensive attitude that almost borders on antagonism. Suggestions are often misinterpreted as criticisms.

The industrial engineer is going to be confronted by the attitude that the *front office is different* — that clerical procedures which involve a multitudinous variety of operations do not lend themselves to analysis and standardization to the same extent as applied to plant operations. The biggest stumbling block to streamlining the office is expressed in the statement, "My business is different." The experienced observer of clerical operations *knows* that the similarity between office production problems and plant production problems has been increasing (i.e., the differences have been decreasing). The office is more highly mechanized today than ever before. The office manager is more concerned with the quantity and quality of production, time and cost control and the conservation of effort, than at any time since the advent of the "front office" as a major part of the business organization.

My personal definition of office management emphasizes this concept—

> **Office management is the manipulation and control of the elements of an organization (men, materials, methods and machines) so as to produce the best possible results (quantity) of the highest possible quality at the least expense and effort in the shortest possible time so that the results will be acceptable to top-management. In the office, control is the objective and time is the essence.**

It is my personal opinion that *in terms of the work being done and the present methods used to accomplish the tasks*, regardless of efficiency, most offices are understaffed and have attained a relatively high degree of *utilization* of manhours. The present methods involve many "frills and luxuries" that do not produce *value*. Statistics are developed, the value of which lies in their historical concept rather than in their contribution to control. Reports are made and distributed without regard to necessity. Records are maintained, the origin of which is either questionable or forgotten and the continuation of which springs from momentum and custom. Hundreds of letters are written, filed, and preserved, the value of which ceased almost at the time of their writing. Space is allocated on the basis of the false standards of prestige and prerogatives instead of requirements and utility (unnecessary private offices). Few offices know what it costs to write a letter, handle a customer's order, or process a purchase order, and so forth.

In terms of the requirements for simplified clerical operations (with the frills and unnecessary operations eliminated) *it is my opinion that most offices are overstaffed*. There is the indictment and there is the general field for the industrial engineer.

I think it is necessary that you reread the last two paragraphs in order to thoroughly understand the implication.

SPECIFICS IN THE NEW FRONTIER

So far, we have been concerned with broad coverage of the subject. We have tried to point out, without undue criticism, that there is much to be done in the office. We have tried to emphasize that the industrial engineer has a difficult job ahead of him if he applies his energies and experience to solving office

Adapted from a paper presented before the Chicago Chapter of S.A.M., January 1951.

problems. The factory or operating executive thinks in terms of "costs" — the office executive also thinks in terms of costs, but he doesn't have the essential data, and in some cases the willingness to get the data which will permit "unit cost" analysis and comparison. The typical office executive does not *realize* what you and I *know* — i.e., that the office is a production unit and is in many respects a continuation or extension of the factory and plant and as such is susceptible to similar scientific analysis and treatment.

Specifically, what are some of the areas in this new frontier? In my opinion, the following list is fairly representative:

1. Simplification.
   - 1.1 Methods.
   - 1.2 Arrangement.
2. Establishing definiteness.
   - 2.1 Methods (manuals).
   - 2.2 Work load (duties).
   - 2.3 Salary administration.
3. Standardization.
   - 3.1 Forms.
   - 3.2 Methods.
   - 3.3 Equipment.
4. Functional centralization.
   - 4.1 Office services.
5. Human Relations.
   - 5.1 Supervisory training.
   - 5.2 Establishing employees' obligations which arise from employees' benefits.
   - 5.3 Better selection methods.
   - 5.4 Introduction of new employees.
6. Control of office operations.
   - 6.1 Better control reports more promptly presented.

Obviously there are other areas for the industrial engineer, but they are in fact facets of these major points of investigation. A closer scrutiny of these six major areas may answer some of the questions that are in your mind.

SIMPLIFICATION

One of the pressing needs of business is the simplification of methods and the streamlining of office arrangement so as to facilitate a better flow of work. We know that there is a principle of work management that states that the *work should flow from desk to desk with a minimum of physical movement by the personnel.* Simplification which may require the discarding of traditional methods, is often retarded by an unwarranted loyalty to an outmoded procedure. The factors and conditions which produce efficiency under certain circumstances and therefore, dictate certain procedures, are subject to change. As these changes take place whether they be factors of volume, timing, cost or the illusions of control, the system by which accomplishment is attained must also change.

It is no commonplace statement to say that records, files, reports and analyses which are important today *may not remain so "ad infinitum."* The requirements of management are dynamic — they change as the economic and competitive conditions change. Yet, time and time again, we come upon *that unbelievable reluctance to change.*

The simplification of methods requires among other things a willingness to analyze present methods. That analysis is made by means of a flow chart for major routines and a process flow chart of individual operations as they are *presently* being carried out. By this analysis of *present methods* which shows movements, operations, interruptions, inspections, and so forth, it is a relatively easy task to eliminate or at least reduce the non-productive time. *Any "time" spent in producing an unnecessary and useless office product is non-productive.* The incentive for simplification as far as management is concerned is to increase the office production by decreasing effort or by directing effort into more productive channels. This means the same production at less cost or more production at the same cost. It also means better reports in less time. The incentive for the employee to actively and cooperatively participate in work simplification studies is based on the almost forgotten economic principle of *more pay for more work.*

Simplification can be carried into almost every corner of the office. The use of equipment and its arrangement is no exception. Many offices are arranged more from the standpoint of symmetry than from work flow. Files are placed against walls as if moved by centrifugal force totally disregarding proximity to use. However, simplification can be carried so far that useful reports and records are discontinued with the result that many hours may be spent at a later date in reconstructing certain data required by management. Simplification studies must be carefully planned.

ESTABLISHING DEFINITENESS

There are many reasons which can be advanced to explain the difficulties in making the duties and responsibilities of top-management definite — the perimeter of the top executive's position cannot be too rigid. It is interesting to note, however, that some companies have defined (in writing) top-managements' job in specific terms and have issued management manuals. Standard Oil Company, California, is an example with its "*Management Guide.*"

There are no defensible reasons why the duties, responsibilities and factors which affect the clerical employee in his work area cannot be made definite and cannot be applied with a reasonable degree of certainty. The areas where the "principles of definiteness" can be applied are many. One such area deals with methods. The established methods should be reduced to writing and issued to all employees in the form of *manuals.* About 50 to 60% of the companies have manuals in some form.

One area where considerable work needs to be done pertains to the *workload distribution.* It would be my estimate that fewer than 10% of all companies have any basic idea of what the workload distribution is or should be (standard production levels). Most companies make little if any effort *to regulate the flow of work* so that the requirements for man-hours of production can be controlled. No system of priorities has been established for work production with the result that the *requirements for man-hours fluctuate with volume.* The long range effect of this is that these companies staff their offices with *potential man-hours* scaled to meet *peak volume requirements.* Therefore, *effective utilization* of the employees is somewhere around 60% of potential. Supervisors attempt to justify their staff during periods of declining volume (decline from peak production requirements) by directing the productive man-hours to non-essential work. Normally an employee represents 40 potential man-hours of productive effort. The employee may be fully utilized during this 40 hours period — but he is not being *effectively utilized* unless he is producing value— i.e., essential production. Unless the

flow of work is scheduled and regulated, and the essential workload is analyzed, the requirements for productive man-hours pyramid and tasks compete with other tasks for completion; thus resulting in over-staffing. *This is an important area for application of the industrial engineer's skill and experience in expense reduction and manpower utilization.*

Salary administration should be definitized. Comparable work should be paid for at comparable rates within *rate ranges.* The horizontal movement from a minimum rate to a maximum rate on a job class should, *as far as possible,* be based *upon merit as individually applied to each employee's service value.* When mass salary adjustments are made irrespective of merit, *mediocrity is rewarded equally with superior performance.* Mass adjustments should be limited to changes in *base rates* such as in the case of "cost-of-living" adjustments and in the case of adjustments arising from changes in the *basic job requirements.*

STANDARDIZATION

Compared to what should and can be done in respect to standardization, relatively little has been done. One needs only to look at the multitudinous numbers, colors, sizes and composition of office forms to realize the magnitude of the job of standardization.

For example, "invoices." The processing of an invoice as part of the accounts payable procedure probably requires 25% to 35% more time than it should because invoices have not been standardized as among companies. The typist who prepares the transmittal slip or voucher (or the accountant, if the transmittal voucher is a part of the accounting procedure) must distinguish between invoice number, job order number, ticket number, requisition number, route number, etc., in summarizing the invoices being paid—the location of the invoice number on the invoice varies so that a *search and find* (inspection) technique must be followed. Often the "terms" are not clearly shown. The entire composition of an invoice leads to delay and inefficiency.

Another example is found in typewriters. Almost all of you would say that typewriters have been standardized. The National Office Management Association is very much interested in promoting standardization. Through its Standards Committee (working in cooperation with the American Standards Association) they have found some very interesting facts. For example they compared five popular makes of typewriters designated by their manufacturers as "12 inch" machines. The actual paper capacities of these five machines were as follows: 11 inches, 13 inches, 13 inches, 13¼ inches and 13½ inches. The writing lines were: 10 inches, 11 inches, 11½ inches, 11 inches and 11½ inches. The right machine has to be selected for specific tasks which results in different makes of machines being used. The manufacturers' "12 inch" designation is meaningless in actual application (Noma Forum, Volume 25, October issue, page 32, "The March of Standards"). The progress in standardization is much like the Kentucky mountaineer's progress in writing. In much excitement he announced that he had learned to write. When asked what he had written he replied, "I don't know, ain't learned to read yet."

FUNCTIONAL CENTRALIZATION

A principle of organization states that authority should be decentralized as much as possible and functions should be centralized as far as feasible. A very important field of activity for the industrial engineer lies in the development of *centralized office functions,* especially as it applies to such office services as calculating, typing, duplicating and in some cases filing. We call these services "secondary" services. Ordinarily each department is staffed with these services proportioned to the peak demands for the services. Idle time is justified during periods of production declines by pointing to the *importance of providing sufficient man-hours* during periods of peak demand so that all work can be processed without delay. *Work should, however, be processed according to the scheduled completion date,* and sufficient man-hours to accomplish this should be provided. It is not necessary that the man-hours for secondary services (typing, calculating, etc.) come from within the department — they should come from a *central unit* where the requirements of the various departments (which requirements are rarely identical as to time and duration) are anticipated and scheduled. Central service units reduce the cost of office services (if properly set-up and supervised) by the simple procedure of synchronizing the production peaks and lulls of various departments so that a more even demand for the services is accomplished (idle time is utilized in effective production). A simple example shown below will illustrate this point.

I have used an example in which there is a narrow range in the demand for man-hours. On a decentralized basis, each department would be staffed to meet maximum demand: Dept. A — 24 hours; Dept. B — 21 hours; Dept. C — 23 hours — for a total of 68 man-hours per day, or 8½ to 9 employees at 8 hours per day with no allowance for "break periods." By centralizing the secondary services and by applying the man-hours to the actual requirements of each department on a daily demand basis, only 56 man-hours (7 employees at 8 hours per day with no time allowance) are required. This is a savings of

Man-Hour Requirements for Secondary Services by Days

Dept.	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F
A	24	23	22	22	18	23	23	20	18	18	24	23	21	20	18
B	20	20	20	16	15	20	19	21	20	15	21	20	19	15	14
C	12	12	14	18	23	13	14	15	18	23	11	13	16	21	23
Total Require.	56	55	56	56	56	56	56	56	56	56	56	56	56	56	55
No. of Empl.	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
If not centralized, full req. for all depts.	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
No. of Empl.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

1½ to 2 employees per day.

This is a complete subject in itself. Most of our increase in productive efficiency has come from better methods, higher skills, better working conditions, better machines — all of which are physical or tangible in conception. The physical aspects of employment have been improved beyond imagination during the past 30 to 40 years. Technological advances have been very important. In the next 30 to 40 years increases in productive efficiency are coming mainly from advances in the techniques of handling human relations. We have a big job ahead of us in supervisory training — in handling people and in developing a pattern of contact that gets away from the purely social theory that the employers are the only group with "responsibilities." Any pattern of personnel management that does not recognize the responsibility of management to fairly appraise the service value of the employees and to reward them according to their merit falls short of good management practices.

Management has responsibilities to the owners to produce a profit; it has responsibilities to the employees to develop security through sound business methods; it has responsibilities to the community for producing a better service or product at the least possible cost; it has responsibilities to the Government to pay a *fair tax* and operate within the bounds of *reasonable regulations* — none of these responsibilities are, or should be, in opposition to each other. Friction of interests develops when anyone of these groups to which management has responsibilities forgets that in turn it has certain defined obligations to the others of the groups. Every responsibility and privilege gives rise to a reciprocating obligation. *The interests of the owners, the employees, the community, the Government and management are identical.* The sooner that we learn *that no group can prosper and progress at the expense of the others* the better off we will be.

CONTROL OF OFFICE OPERATIONS

Office management is in fact control — the purpose of sound office management practices is to develop sound control of the forces of the organization as found in men, methods, machines and management. We are always striving for better quantity and quality of production and less effort and expense in attaining this goal. No one can control that which they do not understand. To control, one needs information. In the effort to obtain this information, management finds that it must read and digest volumes of information in order to get the facts necessary for sound management decisions. This imposes a burden upon management. Office management attempts to set up a minimum of control information which experience has proved to be valuable. In effect the multitude of statistical and analytical data are screened and reduced to essentials. In my opinion, the control instruments (reports) of management (as regards office management) are:

1. **Organization chart.**
2. **Job analysis.**
3. **Flow chart (of entire routine).**
4. **Process flow chart (of individual jobs).**
5. **Work load distribution chart.**
6. **Time analysis (time required to process paper work).**
7. **Budgetary Report.**
8. **Labor turnover *analysis*.**
9. **Floor plan (integrated with flow chart).**
10. **Form and report analysis.**
11. **Production Index Unit (group efficiency measure).**
12. **Periodic reports to Management.**

Space does not permit a description or explanation of these instruments of control. All of these instruments have been used for decades by scientific factory management. Their introduction to scientific office management should raise no concern.

The "plum" of the front office will not be an easy one to pick. The industrial engineer must recognize the differences in environment and philosophy that prevails in the front office. I think possibly that a quotation by Henry Ward Beecher will illustrate this point.

> "In the ordinary business of life, industry can do anything which genius can do and many things which it cannot."

The Ninth International Management Congress

Brussels, Belgium
July 5-11

By HAROLD SMIDDY
Vice President,
General Electric Company

BACK IN 1924 a few forward-looking engineers and businessmen went to a management meeting in Prague, Czechoslovakia, to exchange management techniques with others from all over the world. Frank Gilbreth was to have been one of the principal U. S. delegates. We all know the story of how Lillian, his wife, went in his place. And we also know how successful that meeting, known as the *International Management Congress*, was—how it inspired others to carry on the idea.

Idea? Perhaps ideal would be a better word for it. For if we in management—American, European, and Latin American—cannot exchange our ideas on the high level of a profession—then we have little call indeed to take issue with those in the political arena.

The ultimate ideal of the Congress, I believe, is to make management a profession. We haven't achieved this goal yet, but we have made progress. In the subsequent *International Management Congresses* more and more progressive management personnel the world over—at least those with vision—have come to accept them as something management must do if the world we know is to survive.

Most of you know about the *National Management Council.* It represents the SOCIETY FOR ADVANCEMENT OF MANAGEMENT, and many other such groups, as well as companies and universities, in the perpetuation of these *International Management Congresses.* Most of you know the story of CIOS, *the International Committee of Scientific Management,* so we won't go into it here.

But we do want to urge your attendance at the *Ninth International Management Congress* which is to be held in Brussels, Belgium, July 5-11. When we say that our host is to be the Prince Royal of that country, you will easily

(*Continued on Page* 27)

The Snap-Back and Continuous Methods of Taking Time Study Readings

By ADAM ABRUZZI, Ph.D.

Department of Management, Graduate School,
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A straightforward appraisal of two methods for using the engineer's basic work measurement tool. More fuel for the debate about "independent" operation elements.

MUCH CONTROVERSY EXISTS among time study writers concerning the relative advantages of the continuous and the snap-back method of taking time study readings. In the first case, the stop watch is allowed to run continuously while the observer makes readings; in the second the stop watch is read and the hand returned to zero at the end of each operation element. A striking example of the contradictory points of view on this question is provided by the statements of Carroll and Schutt. Carroll's view is that, though the snap-back method involves a small mechanical error, "this is inconsequential in comparison with the probable errors in judgment included when rating the performance." [1] For that reason, he recommends that method except for special cases, such as extremely short operations. Schutt, on the other hand, reasons that the snap-back method is a poor measurement method, largely because of exactly the same mechanical error (i.e. the loss of time involved in starting and stopping the watch).[2]

The other principal arguments given in favor of the snap-back method are that: (1) elements can be recorded out of their proper order without requiring any special notation; (2) the occurrence of delays need not be recorded; and (3) a decision can be made as to when to stop taking readings.[3] Besides Schutt, Mundel (and many other writers) argues in favor of the continuous method, pointing out that the snap-back method may give consistently high and low readings, leading to a sizeable error with short elements.[4]

THE VALIDITY OF THESE CLAIMS

By far the most decisive argument against the snap-back method is presented by Lichtner, who writes that "one element should not be abstracted and timed apart by itself. The time taken to perform one element is more or less related to the time taken for the preceding element, since the employee usually swings from one motion to another without the slightest hitch or stop." [5]

Lichtner's observation implies that the elements in an operation are mutually interdependent, a point that has been conclusively demonstrated by extensive research studies made by the writer.[6] Accordingly, the argument that transposed elements and delays need not be recorded can readily be dismissed.

The claim that the snap-back method enables a decision to be made as to when to stop taking readings is likewise erroneous. It encourages observers to make such decisions on the basis of the readings already obtained; this is a statistically unsound procedure and is capable of yielding estimates that are neither accurate nor precise.

Rogers' Results. In an extended series of direct studies, Rogers found that the snap-back method promotes careless observation, a tendency to anticipate readings, and a tendency to read the stop watch consistently too high or too low.[7] The seriousness of these difficulties is clearly demonstrated by his numerical results. Using data obtained by the continuous method as a yardstick, the average error involved was ± 10 percent, with a total error range of ± 5 to 20 percent.

The Writer's Results. A series of laboratory experiments and statistical tests on this subject has recently been completed by the writer. The observations were made with calibrated instruments by two observers, one (observer A) with ten years' experience and the other (observer B) with one year's experience. The experiments were performed on a simple three-element bolt and nut assembly operation, performed by a skilled observer whose average time for the complete cycle was approximately .10 minutes.

In experiment 1, observer B experienced no observational difficulty with the continuous method. But observer A, using the snap-back method, missed two cycles completely in addition to several element readings and delays. The snap-back results were actually so poor that it was impossible to make any meaningful statistical analysis of the two sets of 20 readings obtained.

In experiment 2, observer B used the snap-back method and observer A used the continuous method. Because of his much longer experience, observer B had much less difficulty with the snap-back method and missed only a single cycle. The 19 remaining pairs of readings were then subjected to a series of advanced statistical tests intended to compare their most important statistical properties.[8]

The first of these tests showed that a much stronger relationship existed among the elements as recorded by the continuous method than as recorded by the snap-back method. In further tests, the corresponding average element times and cycle times were found to be significantly different, although the difference between the average cycle times were much less pronounced than the differences between the element times.

In a final test, the degree of variation in each set of readings was computed in terms of the standard deviation.[9] The standard deviations for the elements and the cycles were then compared and found to be of the same order of magnitude.

The third and concluding experiment was made immediately afterward and under the same conditions. The results,

which are recorded on the table, are also representative of those obtained in the preceding experiment. The symbols X and S designate the average and the standard deviation, respectively, of each set of readings.

The almost constant readings for the first element bring up a point of fundamental importance concerning measurement methods and their properties. These readings illustrate the fact that constancy appears to exist when the element observed is of the same order of magnitude as the measuring instrument. This implies that constancy is not a property of the element itself. Instead it shows that the measuring instrument is inadequate under these conditions and should be replaced by one which is more sensitive.[10]

The table also shows that the snap-back element times are consistently smaller than the corresponding continuous times. The same situation exists to an even greater degree in the cycle times; this accounts for a total elapsed time of 1.97 minutes for the snap-back method as against the much greater time of 2.25 minutes for the continuous method. It is clear, then, that, with short elements at least, snap-back errors are all in the same direction, becoming cumulatively large for a time study of any length.

Here again a series of statistical tests was made. As in the preceding case, a much stronger relationship was found to exist among the elements as recorded by the continuous method. This fact has an important practical implication, especially regarding short elements. It shows that the snap-back method involves a sufficient loss of time so that the natural relationship among elements is artificially destroyed. Results like these give the impression that operation elements are independent, which is an erroneous though rather widely-held view.[11]

The other tests verified the conclusions suggested by an inspection of the table. They showed that the snap-back average times were significantly smaller; the standard deviation values, however, were of an equivalent order for the two methods.

SUMMARY OF RESULTS

These studies demonstrate that the snap-back method has the following practical disadvantages: much more manipulative ability is required to obtain useful results; delays and extremely short elements are difficult to record; and a sizable cumulative error must be expected in the total elapsed time of a study.

	Observer B Continuous Element				Observer B Snap-Back Element			
	1	2	3	Total	1	2	3	Total
	2	5	2	9	3	4	4	11
	2	2	2	6	2	3	2	7
	2	4	4	10	3	4	4	11
	2	7	3	12	2	10	3	15
	3	3	3	9	3	5	2	10
	3	3	4	10	3	4	5	12
	3	4	9	16	3	5	3	11
	3	2	2	7	2	2	2	6
	2	2	3	7	2	4	3	9
	2	2	2	6	2	2	7	11
	2	3	5	10	3	3	4	10
	2	3	2	7	2	3	5	10
	2	2	3	7	1	4	5	10
	2	4	2	8	3	4	3	10
	3	2	4	9	4	4	3	11
	3	3	3	9	2	2	6	10
	2	3	4	9	4	2	3	9
	3	3	2	8	4	3	9	16
	2	3	8	13	4	10	3	17
	3	10	3	16	3	3	4	10
X	2.76	4.00	3.95	10.71	2.43	3.52	3.43	9.38
S	.84	2.19	1.75	2.63	.50	1.92	1.91	2.82

These practical disadvantages exhibit themselves analytically in the form of underestimates of the averages of both element times and cycle times, with the percentage error smaller in the case of cycle times. On the other hand, the degrees of variation obtained from the continuous and snap-back methods seem to be of the same order, both with elements and complete cycles. Thus the snap-back method is less *accurate* than the continuous method, where accuracy is measured in terms of the error of estimate. However, the two methods are equally *precise*, where precision is measured in terms of the degree of variation.

In essence, then, the stop-watch is changed by the snap-back method into a measuring instrument with fundamentally different properties, especially with short elements. The use of this method can thus be justified only with long elements, where the percentage error is somewhat smaller. In view of the other difficulties involved, such as the erroneous conclusion that operation elements are independent, the continuous method is clearly superior in all cases where accurate and unbiased results are required.

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[2]W. H. Schutt, "Time Study Engineering" (McGraw-Hill, 1943), p. 54.

[3]This is the sense of the arguments used, for example, by W. G. Holmes, "Applied Time and Motion Study" (Ronald, 1938), pp. 172-174, and by F. W. Shumard, "A Primer of Time Study" (McGraw-Hill, 1940), pp. 35-37.

[4]M. E. Mundel, "Systematic Motion and Time Study" (Prentice-Hall, 1947), p. 148.

[5]W. O. Lichtner, "Time Study and Job Analysis" (Ronald, 1921), p. 168.

[6]These studies and their practical implications regarding standard data and other aspects of time study practice are described by A. Abruzzi in "Experimental Procedures and Criteria for Estimating and Evaluating Industrial Productivity," a doctoral dissertation approved by Columbia University, May, 1950. Readers interested in the full details can obtain a microfilm copy from University Microfilms, Ann Arbor, Michigan. Plans are also being made for its commercial publication with the year under a revised title.

[7]H. B. Rogers, "Making the Stop Watch Observation" (Proceedings of the Time and Motion Study Clinic, Industrial Management Society, Nov., 1941), pp. 12-13.

[8]The theoretical aspects of these so-called multivariate tests are described in S. S. Wilks' "Sample Criteria for Testing Equality of Means, Equality of Variances and Equality of Covariances in a Normal Multivariate Distribution" (Annals of Mathematical Statistics, Volume 17, 1948). A simplified explanation, with numerous worked-out examples, is available in the reference given in footnote 6.

[9]The standard deviation is the most common and efficient statistical measure of variation.

[10]This point is fully documented by numerous other studies made by the writer (c.f. footnote 6), in which the constancy disappears when the elements are measured with a more sensitive measuring instrument like the marsto-chron or wink-counter.

[11]See, for example, A. B. Segur, "Motion Time Analysis" (Proceedings of the Time and Motion Study Clinic, Industrial Management Society, Nov., 1938), p. 38.

Industrial Engineers' Relations with Accounting

By J. L. WILSON

Director Inventory and Cost Accounting
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Towards more knowledge and better understanding between two groups with many common interests.

IF ONE IS TO BE SUCCESSFUL in his chosen field of endeavor, it would seem that he should widen his knowledge of related activities, even though they may be somewhat foreign to his own immediate sphere. The acceptance of this philosophy will change an individual's perspective and objectives, and will undoubtedly influence his conclusions and decisions. Therefore, if we are to perform in a more satisfactory manner, it behooves each of us to learn more about the reasons for performing our daily bit, and how the results of our endeavors merge and blend with the results and endeavors of others.

The subject of this article could very easily be reversed to read "Accounting Relations with Industrial Engineers."

During the past decades it was not, as a general rule, customary for any of us to trespass on the other's territory, and the necessity for knowing how various phases of our work and activities integrated with others' was not considered a serious matter. Management itself often took the view, for instance, that accounting was only a necessary evil, and that the accountant with his benign look and green eyeshade didn't know what he was doing anyhow. Somewhat belatedly perhaps, but none the less forcibly, Governmental requirements (both State and Federal), consternation over the high cost of living, fears of widely proclaimed forthcoming recessions, and the confused claims and counter-claims of those engaged in wage negotiations, focused attention on the influence that current economics have on the ultimate results of a company's operations.

If it is true that top management was often delinquent, it stands to reason that this attitude filtered down through the organization and was practiced to a much greater degree by the line organization.

It has been said, and logically so, that the most important asset to a company is trained personnel. Correctly interpreting the term "trained personnel" does not necessarily mean that the individual should be trained only on his particular job, but he should also be trained and have a working knowledge of related phases of the operation.

THE BROAD VIEW

Industrial Engineering, in its broadest sense, covers a wide variety of specific duties and this diversification makes it more imperative that these people have a broad knowledge of almost every phase of an operation. They should, above all, know the accounting aspect, and how it integrates with their own activities.

I will attempt to confine this article to the Industrial Engineer's duties as they relate to the establishment of incentives, methods, processes, routings, production standards, cost reductions, etc.

To be thoroughly satisfactory to both operators and management, wage payment plans, regardless of type, must possess certain characteristics; they must be easy for the operator to understand, must be economical to administer, must offer an incentive, and must provide a minimum guarantee.

I believe you will agree with me that there are occasions when our wage payment plans, due to the failure to observe fundamental principles, the injection of modifications, and lack of proper administration, become so complicated and confusing that many of us do not have a clear and precise understanding of the intended functions. This is very serious because wage payments, involving the dispersal of the company's funds, may be based on records and principles of possible doubtful accuracy.

Industrial Engineers should understand the fundamentals and detailed workings of the plan being used, since their records form the basis for compilation of payrolls.

We each have a definite responsibility. The Industrial Engineer's is to see that correct routings and methods are observed to provide incentive measures which are fair to both operators and the company, and to administer the plan effectively; while the Accounting Department must accept the Industrial Engineer's records as bona fide and, from that point, calculate efficiencies, and finally produce a payroll.

There are many more ramifications than those mentioned but, in the final analysis, we are both charged with the responsibility of determining an accurate payroll.

While the Accounting Department is closely associated and related to other activities, I believe it can be safely said that our interests are more closely related to Industrial Engineering than possibly any other. This being true, there is no question but that we should cooperate with each other to the fullest extent and coordinate our work in order to solve the problems at hand.

Incidentally, not all of our Industrial Engineers have had fundamental accounting training and, likewise, our accountants have not had training along Industrial Engineering lines. It is self-evident that our problems would be much less severe if we understood what each was doing and established methods, systems and schedules with a full knowledge of the other fellow's problem. I am quite positive that if the Industrial Engineer knew what is involved in calculating an operator's pay, there would be less cause for constant contact and griping

about the so-called deplorable condition of the records. I know that you all have, at some time or other, experienced a condition where more time than could be justified was consumed in trying to straighten out apparent irregularities. It has always been my contention that it is easier to do a job correctly than it is to do it incorrectly and, by the same token, we may save many hours of valuable time in checking and rechecking to correct conditions that should never happen.

The Industrial Engineer should be familiar with our labor statements to the extent that he knows the origin and meaning of every figure reported. Undoubtedly every company produces a labor statement of some kind which points out the productive hours, productive labor, extra allowances, setup hours and setup costs, payroll or production workers on expense work, and payroll on full time expense workers. These statements are definitely made for the benefit of the line organization and, if they are not used properly and intelligently, there is not much point in maintaining such records. Setup hours and setup costs are of particular interest to the Industrial Engineer, even though the information is historical. I believe much can be done by the Industrial Engineering organization to see that operations and quantities can be combined to reduce the cost of preparing and setting up the job. Of course, the time to correct this is not after the damage has been done but before; however, a full knowledge of what such operations cost will provide an incentive for the line organization, including Industrial Engineering, to take corrective measures.

THE PROBLEM OF ALLOWANCES

It may be that other companies do not have a serious problem involving so-called extra allowances. This has been a problem with us for many years. Extra allowances are recognized as legitimate transactions when the occasion demands that extras be paid for irregular operations, change in routing, material variations, etc. It is very easy to abuse a practice of this kind because it provides a means of subsidation which should not be considered legitimate, unless it is the policy of management to subsidize groups or individual workers. It should be a function of the Industrial Engineering Department to approve all such transactions, and they should be aware of the effect that such payments have on the ultimate operations of the particular division or plant. For many years we have attempted to bring these extra allowances out in the open through an analysis which, again, is only historical; however, we have in mind that such information will encourage those responsible to take corrective measures.

Another item that has caused grave concern is that of so-called special time allowances. Special time allowances today are somewhat different than they were a number of years ago, when changes could be made in these special allowances if they were found to be incorrect. Under present day conditions these allowances are not so easily modified and, after a time, become practically a fixed value from there on until the method or process is changed. Industrial Engineering should certainly know the effect that such allowances have on costs and, ultimately, on profit and loss.

The method of handling day work is another item that deserves attention and consideration. I do not believe that any fair-minded accountant would take the stand that day work is not necessary at times; however, it must be controlled. At some plants in Westinghouse we have a complete day work system and, unless there is some measure or standard placed on operations that will provide a measure of efficiency, it is rather difficult or impossible to tell how efficiently our plants are operating. At several of our plants where day work is involved, either wholly or to a large extent, we establish standard time values on the same basis as if such values were used for wage payment. Likewise, reports are rendered daily, weekly and monthly as to how efficient our operators are. The Industrial Engineer should have a definite knowledge of how costs are compiled under a day work system and the effect that overruns or failures to meet standards have on operations.

At most plants in our Company we have and observe what is known as a standard time system. This provides that a time value be established for each and every operation or, in the case of groups, a group of operations. These standard values are used for the compilation of standard costs and any variation from such standards is written off currently as a gain or loss. If I were an Industrial Engineer I would certainly want to know what the gain or loss was by groups, production centers, departments and divisions.

BUDGETARY CONTROL

During the last two decades, most industrial concerns have adopted, in some form or other, a budgetary control. The Industrial Engineer might claim that a knowledge of such controls is of no importance to him, in that they are the responsibility of the operating personnel who are, or should be, obliged to meet certain standards or goals established. Certainly this would be the wrong attitude and it is my contention that the Industrial Engineer should be interested in these matters to the same extent as others. He should have an intimate knowledge of what comprises factory expenses and how these expenses enter into the cost of sales, just as direct labor and materials do. Most firms compile expense statements in some form or other, and these statements should be studied and compared in order to detect shortcomings and, if possible, recommend or take corrective measures.

As a rule, expense control statements show the actual expense, the budget expense, and the amount that is cleared to inventories, which permits the showing of two variances—a budget variance and a cost variance. Expenses should be budgeted in the budget center or department where they are controlled, regardless of the ultimate disposition of the charges. Above all, budgets should be so established that they are attainable, as an unattainable budget is little better than no budget at all.

As stated above, where a standard cost system is in effect, regardless of whether the operators are on this basis or on a day work basis, these costs, of necessity, form the basis for price negotiations. Naturally, if large variances, either favorable or unfavorable, are developed, adjustments must be made in the total overall cost if we are to furnish the Sales and Engineering Departments with intelligent estimates on projects under negotiation.

You are aware that the cost of sales is not only the standard cost, plus or minus variances, but is also the cost of engineering, selling, overall administration, and other items of expense. It would seem essential that the Industrial Engineer have a knowledge of how ne-

gotiated costs are compiled and what enters into such costs.

In the not too distant past, many of our accounting terms may have been more or less Greek to the average Industrial Engineer; however, I believe that most of you are familiar with such terms as debits, credits, assets, liabilities, net worth, equities, ownership, classification of accounts, and so forth. A simple way to make a balance sheet understandable is to think of a very simple equation; that is — What You Own equals What You Owe. What You Own, of course, represents grounds, buildings, equipment, inventories, securities, cash and possibly other items; while What You Owe represents your obligations to your suppliers, your workmen, and your stockholders who have made the initial investment.

One of the most important items under What You Own is undoubtedly inventories, and the Industrial Engineer can do much to control these assets. As mentioned in the foregoing, the Industrial Engineer in establishing routings, time values, and determining methods practically controls the labor element of our inventories, and also a large portion of the overhead and material content. Obviously, the control of inventories is a joint responsibility of Engineering, Production, Time Study, and Accounting. The Production Department should see that stocks of material are kept to an absolute minimum commensurate, of course, with requirements and should establish schedules adjusted currently and frequently to coincide with forecasted requirements. The Accounting Department's part in the control of inventories is to see that proper records are maintained reporting receipts, issues, and balances currently to eliminate the possibility of management making wrong decisions. The Industrial Engineer should see that proper routings and time values are established, and eliminate as much as possible irregular operations in order to keep inventories at a minimum valuation.

INVENTORY CONTROL

The problem of inventory control is one that should receive the utmost attention since, in many manufacturing concerns, it may represent as much as 25 to 50% of the total assets. Dead inventories are only a drug to a corporation, tying up cash that may be needed for other purposes. Another reason that inventories should be properly controlled is that this permits leveling production, so that violent fluctuations from period to period do not occur.

In this day of constantly rising wages and material costs, it is more important than ever that inventories receive the proper consideration. In this connection, if we are to keep our selling price levels in line with competition, it becomes necessary to exhaust every possibility that may result in a cost reduction without in any way affecting the quality of the product. Each year a cost reduction goal should be established and religiously followed to see that the most is obtained in the way of improved costs. In this instance, the Industrial Engineer plays an important role because it is through him that the most economical routings, methods, and procedures applicable to manufacture are established. The Accounting Department's responsibility in connection with cost analysis and cost reduction is to point out apparent irregularities in cost, and compile and report cost savings on projects under consideration.

COST REDUCTION

Undoubtedly, the Industrial Engineer should understand the cost procedure followed in arriving at the figures reported. Also, they should be fully aware of what elements of cost should be included when calculating cost savings; that is, for the most part, cost savings are composed only of direct labor and direct material and, occasionally, overhead or burden may be involved. I have found occasions where the cost savings reported by a particular department aggregated over a period of several months more than we were actually spending in the department. In fact, one of our works managers called his Cost Reduction Group together on one occasion, and remarked that the day had arrived when the employes must be paying an admission fee to come to work, since the cost reductions reflected on the reports were a damn sight more than we were spending.

PLANNED MEETINGS

Your Accounting Manager or Representative should from time to time sit down with you and review the company's complete operations from beginning to end, as they apply to your particular location; that is, how timekeeping leads into payroll, how payroll leads into inventories and expense, and how the combination of expense labor and expense material likewise leads into inventories; finally, how inventories eventually become that portion of the cost of sales known as Works Delivery Cost and are finally reflected on the Profit and Loss Statement. I believe you should also have a working knowledge of how materials are received, how bills for material are paid, how the value of material becomes a part of our Work in Process inventory and, eventually, how these materials become a part of our cost of sales.

The Profit and Loss Statement, in the final analysis, is very simple. You sell your product at a stipulated price and, when billing is made, the accumulation of these figures is known as Net Sales Billed. Assuming that there is no other source of income, all costs, that is, Works Delivery Cost, Sales, Engineering, and Administration must be plotted against these figures and what is left is known as profit. Sure, in the larger firms there are many many entries and many many items that make up the cost of sales; also, quite likely there are sources of income other than the sale of products. Regardless of this, the theory is the same and, once you have the theory, little difficulty will be experienced in following through the many transactions involved in arriving at a profit figure.

The Balance Sheet is another important statement that the Industrial Engineer should know about. The Balance Sheet will show the status of a company and, without such an instrument, many decisions could be made that would throw a firm into bankruptcy. We in Westinghouse attempt to make a Balance Sheet for each and every division of our company. True, there are some overriding items that we do not reflect in these balance sheets; however, we have provided an instrument that is of great value to the Manager of a particular division or location.

In summing up this discussion, I would like to say that the Industrial Engineers need the accountants and vice versa. We each have a definite responsibility and how we meet that responsibility will have a definite effect on the final operations of a company.

The Effects of Quality Standards on Production Standards

By WILLIAM A. McCONNELL
Industrial Engineer, Jones & Laughlin Steel Corporation

Examining the goals of Quality and Production from the operation-as-a-whole point of view and relating those principles to individual tasks.

THE RELATIONSHIP between the Quality Control Department and the Industrial Engineering Department is demonstrated by our views of such fundamental problems as,

How are Quality Control Standards and Performance Standards integrated?

What are the results when quality standards are not properly recognized when setting Performance Standards?

How can we determine whether Quality Standards are adequate for proposed Performance Standards?

How should we treat the mechanic who normally likes to do a very workmanlike job and who spends more time to obtain a finish that is not justified? (There are still some workers who actually have that attitude towards their work, believe it or not.)

These basic questions point up the fact that we should give thought specifically to the *relationship* between Quality Standards and Performance Standards rather than think in terms of "Effect Upon."

It is the Industrial Engineer's function to correlate Quality Standards and Performance Standards so that no lowering of required quality results from the establishing of Performance Standards, and that no decrease in potential productive capacity, results from improper consideration of Quality requirements.

The Industrial Engineers' job with respect to Quality as related to Performance Standards thus defined, how are we to *do* the job?

First let us examine the tools with which the Industrial Engineer has to work.

We would consider as tools,

(a) The worker's obligation, imposed either by authority or the inherent nature of the job, to prevent loss through damage to materials; his obligation imposed for attention and care to prevent damage to tools and equipment with which he is actually working or which come under his control.

(b) Supervisory responsibility for the establishment, determination, and enforcing compliance with; required standards, controls, instructions, specifications, and the responsibility for the development and improvement of products, processes, methods, practices and procedures.

(c) Quality Control and Engineering Service organization's responsibility to provide the proper relationship between the results of their activities as concerns Quality Standards, specifications, inspection, testing, and so forth, and attainable productivity of the worker, the equipment, and as well, the operating supervisory function.

(d) Responsibility of all other Management functions, including Sales, to the ultimate objective of a better product, at least cost for the benefit of owners, employees, customers, and public.

There are other so called tools with which the Industrial Engineer has to work but these will suffice for the moment.

You may already be of the mind that those so called "tools" merely describe obligations or responsibilities of the several worker and Management functions. You are probably wondering how, as an Industrial Engineer, you can *use* those intangibles to find out whether a Scarfer conditioned a bloom properly; or whether the Machine Operator was using proper speeds, feeds, and so forth to obtain proper finish; or whether a continuous annealing operation is under the best possible practice, the while producing within the required physical content limitations and so on.

IMPORTANT INTANGIBLE

On the other hand, consider that if (and this is a great big if) all of those obligations and responsibilities of workers, supervisors, quality control technicians, engineers, and other related Management functions were carried out perfectly towards the ultimate objective of the better product; at the least cost for the benefit of owners, employees, customers, and public; the Industrial Engineer, engaged in the establishing of performance standards, would have *no problem*. He would merely make his necessary determinations on the basis of things as they present themselves at time of study, place his standards in operation, and go his merry way happy in the realization that his standards represented *his* perfect discharge of the Industrial Engineering responsibility.

Alas, such is *not* the case and the Industrial Engineer must call upon the more practical and infinitely less etherial, tools of his profession to realize his particular objective with respect to Quality Standards and Performance Standards.

What are these more practical tools?

First — Study. Not only first but last and always. Time Study, Motion Study, or whatever other type of study is necessary to bring out *all* of the facts concerning any given piece of work, whether manual or equipment.

Secondly — Technical knowledge; electrical, mechanical, chemical, metallurgical, or what have you, together with

the assistance of the specialized knowledge of operating supervision, process engineers, quality control technicians, and others.

The Industrial Engineer, of course, has other practical tools to use, but study and the supplemented technical knowledge are the fundamentals which are absolutely necessary of application to bring out *all* of the *facts* concerning any given piece of work on which performance standards are desired to be established. This applies whether that work is performed by man or machine. Furthermore, these facts *must* be developed so as to enable sound determination of the best method, the best performance, the least cost, and finally, but certainly not the least important, the *proper* relationship of Quality Standards to Performance Standards.

Let's get a little closer to the subject and direct some of these factors or tools into somewhat more practical channels in the form of tracing a pattern of establishing performance standards wherein quality standards must be given full weight and consideration.

Generally speaking, it is difficult to conceive of any particular application where quality standards in one form or another would *not* be of concern in the developing of proper performance standards.

Specifically, the first step in the development of proper performance standards is, of course, preliminary analysis of the job. This preliminary analysis of the job is a function of the Time Study Procedure, as performed by the Industrial Engineer, and is to determine the facts as they exist and the reasons therefore. It is here then, in the preliminary analysis of the job, that quality standards or requirements as they exist are first encountered and must be given proper consideration. The use of the facts of the job is to enable the determination of proper Standard Practice.

STANDARD PRACTICE IN ACTION

What is meant, then, by the Standard Practice? The term Standard Practice is defined to mean the *specified method* for the use of equipment, crew, materials, and services for the performance of a given operation in the manufacture of a specified product or service.

Directly related to Standard Practice, or in other words the specified method, is the fundamental principle that the total results of operations will be less than satisfactory, to affected employees and Management alike, in any given situation that involves: (1) under-utilization of equipment; (2) spoilage or waste of equipment, materials, products, or services; or (3) ineffective processes or methods. Although there are other instances of less than satisfactory results such as waste of time, unbalanced distribution of work, failure to provide effective facilities, etc., which are of equal importance in the Industrial Engineering responsibility to the determination of *proper* performance standards, those three first enumerated specifically reflect the necessity for the critical scrutiny of existing *quality* requirements of the job, determination of *proper quality* requirements, comparison of the actual quality requirements in effect with *proper* quality requirements and adjustment of actual quality requirements *to* proper quality requirements where necessary. This should be through the medium of the establishment of and conformance to, proper Standard Quality requirements as spelled out in Standard Practice.

Then, the Quality requirements incorporated in Standard Practice will reflect a level of attainment which engineering analysis, studies, and comparisons, indicate can be achieved under stated operating conditions with existing equipment operated by best methods, and shall be so established as to take into account the most favorable utilization of equipment, labor, and material for attaining the lowest manufacturing cost.

In the more detailed development of Standard Practice, these factors should be reviewed as to proper practice on existing equipment or conditions:

1. Job layout: Arrangement of equipment, flow of materials, etc.
2. Processing procedure: Sequence of operations, utilization of equipment, inspection, etc.
3. Materials: Utilization, yield, specifications, etc.
4. Materials handling: Stocking, marking, methods of handling, movements, etc.
5. Labor utilization: Work loads, routine of duties, etc.
6. Automatic controls: Signals, etc.
7. Clerical reports, records, etc.

It is in the study of the factors (2) Processing procedure and (3) Materials that the particular data, necessary for proper Quality Standards to be incorporated in Standard Practice, is to be Found. It is fundamental that yield or quality requirements alone should *not* be used as a determinant for performance standards. However, performance standards should apply only to the unit of production, weight, count, and so forth, which is of *acceptable* quality.

Basically, then, it is in the determination of what is *acceptable quality* that the Industrial Engineer will develop those facts which bring to light the necessity for changes in the existing quality requirements. He will find that, for example, a certain piece of equipment designed for production to meet certain predetermined quality requirements, may be operated at faster speeds than manufacturer's specifications and still meet the demands of acceptable quality. He may find that the predetermined quality requirements may differ widely from acceptable quality requirements and that the former are too critical, resulting in longer than necessary time taken to produce a given unit of production. He may find wide differences in the understanding of predetermined existing quality requirements on the part of operating supervision. He may find wide differences of understanding of existing predetermined quality requirements even between concerned quality control technicians, between inspectors, testers, and even the operators or the workers themselves.

His next job is to assemble and analyze all of this information, fit together all of the loose ends, so to speak, and develop acceptable quality requirements as related to the job under study. He must then take the necessary steps to place in operation the acceptable quality standards if existing quality requirements are found from such correlation to result in under-utilization of equipment; spoilage; or waste of equipment, materials, products, or services, ineffective processes, or methods.

Having developed acceptable quality in his own judgment as a result of his intimate knowledge of the job in all its aspects, as obtained from his study, the Industrial Engineer has reliance to a certain extent upon those so called intangible tools mentioned previously.

Those obligations or responsibilities of the various other workers, supervisors, technical services or related Management functions.

With recognition by the worker of his obligations to prevent loss through damage to materials, or specifically, to produce a product of acceptable quality, the Industrial Engineer should have little difficulty in providing necessary facts and data to enable the mechanic, using more time to obtain an unjustifiable finish, to understand that by so doing, he is actually performing his work in a fashion which is detrimental to the mechanic's own interest, that of his supervisors, and of his company. Of course, tact and understanding should accompany any such necessary approach which should also be contingent upon acceptance by, and in conjunction with, immediate supervision.

THE SUPERVISOR'S RESPONSIBILITIES

Supervisory responsibility for compliance with *required* standards is of distinct helpfulness to the Industrial Engineer faced with the necessity of the supervisor's acceptance and adoption of a change, for example, from the Scarfer's practice of making ½" deep cuts only 1" across to the proper practice of a 2" wide cut to a depth just sufficiently below the surface to remove the defect. He has the facts and data from his studies to prove beyond all doubt that the too deep cut results in rolling overlaps resulting in scrap in the next operation of rolling and also that the improper practice results in unnecessary work on the part of the Scarfer, and excessive costs from unwarranted use of expensive oxygen and other materials.

No great call upon supervisory responsibilities or the responsibilities of the quality control technicians is required to change the existing practice of a .023" feed per spindle revolution to a .043" feed per spindle revolution in turning to a distance of 10 inches, the 5½" Outside Diameter of a round bar on a Turret Lathe. The Industrial Engineer in the course of his studies has, perhaps from the mere monotony of observation of this particular element as practiced, and certainly from realization of his responsibility to the objective of least cost, has investigated the necessity for such a fine time consuming finish and is able to produce visible evidence that the flame hardening operation performed on this mirror like finish in the next finishing step in another department, results in a final finish with the appearance of a piece of boar's hide.

Every Industrial Engineer of experience would be able to cite similar instances of practices which are inconsistent with proper quality and performance.

He knows that this condition is no reflection on the workers, supervisors, or technicians, but that his particular method of study enables correlation towards proper requirements, both quality and performance, of the somewhat different results from the separate actions of all of these people. In other words, his studies and investigations should eliminate all of those unnecessary tolerances accumulated as a result of the separate viewpoints of all of the others on the team.

With proper quality requirements determined and placed in operation, it is relatively simple to develop proper time allowances for the performance of the work by the best method to produce this desired quality. It is one matter to effectuate such changes but an entirely different matter to insure compliance with the desired quality standards in the future as well as to be able to measure, in the future, further changes in the interest of improved methods or products, or changes in equipment, manufacturing processes or methods, materials processed, or *quality* or manufacturing standards. Such changes, as you well know, require revision of performance standards under most bargaining agreements at least in the Steel Industry.

It is in this connection then, that the incorporating of specified proper quality requirements in, and the establishment of and conformance to Standard Practice, reaches its full and significant value.

FUNDAMENTALS FOR QUALITY

Certain fundamentals are essential to the spelling out of Quality requirements, procedures, or specifications in the defined Standard Practice to be used from the establishing of the related Performance Standards.

These fundamentals consist briefly of:

a. A brief description of the product together with an explanation of its intended use. Do not include such indefinite statements as "Workmanship shall be first class and the product shall be substantially free from defects".
b. Briefly describe the basic materials.
c. Briefly describe the assembly of the basic materials.
d. If the product is packaged, the general information such as the number of units to be packaged in a container should be briefly described.

These general requirements should give a thumbnail description of the product so that it can be identified at a glance without reading through the details.

Detailed quality requirements should also be spelled out in Standard Practice such as:

a. Specify all product characteristics together with the tolerances permissible. Give dimensions, tensile strength, hardness, density, plasticity, chemical reactivity or any characteristics essential in the product or its components.
b. Specify all performance requirements such as drop tests or abrasion tests.
c. Where possible, specify ultimate consumer use requirements.
d. Specify labeling and packaging in detail. Specify control numbers and markings. Specify finish.
e. The number of samples to be tested for each requirement should be specified as well as the frequency of sampling.

These specified quality requirements, incorporated in Standard Practice, become part of the final performance standards upon installation and serve as the guide for proper quality for the use of all concerned.

Thus, having made sound quality requirement determinations as a result of study and his own judgment, verified by other technical services, as necessary, supported by operating management, accepted by the worker, and given proper treatment in performance standards, the Industrial Engineer can be assured of having carried out his responsibility to his particular function on the team to the benefit of owners, employees, customers, and public and, of greater consequence to the subject of this paper, that "THE EFFECT OF QUALITY STANDARDS ON PRODUCTION STANDARDS" shall be nothing less than good.

Upsetting the Setup Bugaboo

By D. P. SWEETSER
Stevenson, Jordan & Harrison, Inc.

The scientific method tackles another "impossible" job.

FUNDAMENTALLY, standards for setting up machine tools and many other tools and devices that are used in industry today are no different than standards which are set for any direct labor or production operation.

The principal difficulty lies in the minds of management or the engineer, because consciously, or unconsciously, they realize that just as much work, thought and effort must be put into the development of a proper standard for setting up a machine which occurs once, as they put into the standard for the operation of a machine which may occur 1,000, 10,000 or even 100,000 times for the single setup.

The Setup, however, does play a vitally important part in the shop which produces one, two or ten pieces. As a matter of fact, sometimes the standard allowance for Setup in this case is greater than the standard allowance for the production of the few pieces.

Let us review for a minute the requirements for a good time standard:

1. Sound basic data which presumably takes the form of standard elements, these having been developed from hundreds or thousands of readings.
2. Intelligent application of these data to the operation at hand, which clearly defines the standard working conditions and the standard motions.
3. Competent supervision which understands the principles involved and is keenly aware of the necessity for the maintenance of standard conditions.

Fortunately, when standard data is used, a development of standards for Setup is neither difficult nor time consuming. As a matter of fact, every properly organized Standards Department

EXHIBIT I
Page 1

STANDARD TIME DATA

POWER FEED MILLING MACHINES
HORIZONTAL, VERTICAL AND DUPLEX

BASE MINUTES AND INSTRUCTIONS	SETUP	
	HOR. & VERT.	DUPLEX
JOB CHANGE ALLOWANCE		
This time will be allowed on every setup. It includes the following work:		
1. Get job and check in. Check out on old job, check in on new, receive blueprint, operation sheet and instructions from foreman when necessary.		
2. Examine Print. Study print and operation card; do all necessary calculations.		
3. Get Tools. Get and arrange all departmental and personal tools.		
4. Clean Machines. Clean chips from table, ways and head.		
5. Adjust table to approximate position.		
6. Set feed and speed.		
7. Take job to inspector.		
JOB CHANGE TOTAL	12.00	13.50
VISE OR FIXTURE		
This time includes all the necessary handling, clamping and normal alinement required to set up and remove these holding devices. It also includes the placing of stops or spacers in the vise.		
Vise / Fixture		
Cincinnati Vise and Swivel Vise / 90 - 200 sq. in. base area	7.00	
ANGLE PLATE		
"U" STRAPS		
Includes assembling and removing block, straps, T bolt, washer and nut in position on table	2.65	
STOPS, BLOCKS OR KEYS (NOT BOLTED)		
STOPS, BLOCKS, KEYS (BOLTED TO TABLE)		
JACK TO TABLE		
Includes place and adjust jack on table to support work	1.50	
PARALLELS NOT CLAMPED - PAIR		
PARALLELS CLAMPED - PAIR		
ROTARY TABLE		
SET VISE OR FIXTURE TO ANGLE		
LAYOUT PIECE		
CHANGE CUTTERS		
1. End mills, Face mills, "T" Slot cutters. Includes attach and remove from arbor. Attach and remove arbor to machine and set to depth.	6.10	
TRIAL CUT - 1 MACHINE TIME		
The time for one full machining cut will be allowed in each setup to make allowances for a trial cut.		
OUTRIGGER SUPPORT OR STOP FOR LONG PIECES		

should be so constituted that standards can be set on the great majority of their direct operations from standard data already developed.

This procedure consists of filling in on a suitable form the proper allowances for the elements of the job. Obviously, in order to do this, the engineer must know the machine and the standard methods for performing the operations which are done upon it.

The same principle applies to Setup with this one difference,—the difficulty of obtaining the basic time data.

If the operator sets up his own machine, the probability is that the time study on that particular operation will include the time for the various elements of Setup. However, in many cases, the operators do not set up their machines —a separate crew does nothing else but Setup.

DEVELOPING STANDARD DATA

In the latter case, it would be easier to get the basic time data by means of time study. However, in order to get a start, a sufficient amount of data to develop good basic criteria must be obtained. It may take a year, or even longer.

Likewise, suitable forms must be prepared for the application of this data to each job. Perhaps these forms could be a part of the form on which the standard allowance for the operation itself is calculated, and obviously the individual who is calculating the allowances must be thoroughly familiar with his job.

Over a period of many years, we have developed such standard data for machine shop practice. Illustrative excerpts follow:

Exhibit I shows the form in which the application of this data to a Setup job is extremely simple. These figures are in total base minutes, which do not include personal, fatigue or delay.

Exhibit II shows a photograph of a vertical milling machine on a simple operation which requires a comparatively simple Setup.

The form which is used for the development of the standard for setting up this machine is shown as Exhibit III. It will be noted that all the pertinent information regarding the operation is filled in suitable spaces on this form,—all the pertinent information as to the

Exhibit II

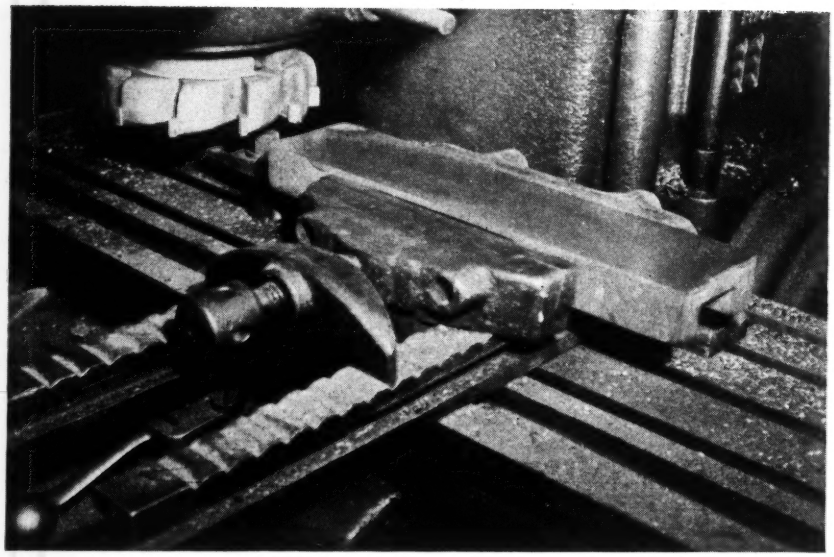


EXHIBIT III

RATE SHEET

Machine Vert. Mill	**Code**	**Part** Cross Heap Bar Guide		**No.** 1	
Operation Mill Bottom Face		**No.** 20	**Material** CI20	**Date** 1/8/51	**By** PLG FL
Tools or Fixtures		**HSS** CARB	**Cutter** FACE	**Dimen.** 6	
		Depth 1/8	**Width** 3½	**Length** 16¾	**Approach** 6

SETUP ELEMENTS	**Base Time**	**Occ.**	**Base Min.**
Job Allowance (Hor. & Vert.)	12.00	1	12.00
Job Allowance (Duplex)			
P. & R. Vise Fixture			
Sq. Jaw to 8″ To 90 sq. in. (Base)			
Cinn. or Swivel To 200 sq. in.	7.00	1	7.00
Large (Hoist) Over 200 (Hoist)			
Angle Plate — Not Alined			
Angle Plate — Alined			
"U" Clamps — Bolts & Blocks			
Stops or Keys — Not Bolted			
Stops or Keys — Bolted			
Jack to Table			
Parallels not Clamped (Pair)			
Parallels Set & Clamped (Pair)			
Rotary Table			
Set Vise or Fixture to Angle			
Layout Piece			
Support or Stop for Long Pieces			
Vertical Attachment			
End Mill, Face Mill "T" Slot	6.10	1	6.10
Slab Saw, Side Mill			
Straddle Gang			
Interlocking			
Duplex — 2 Cutters			
One Test Cut			.94
TOTAL BASE MINUTES			26.04

P. F. & D. 15% **ALLOWED MINUTES (SETUP)** 30.

R.P.M. 287 **FEED** 24″

Exhibit IV

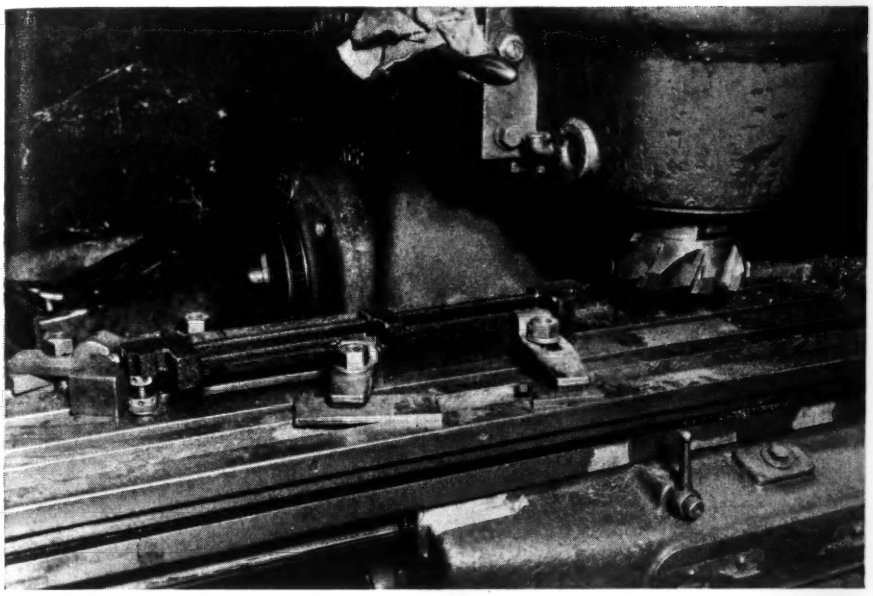


EXHIBIT V

RATE SHEET

Machine	**Code**	**Part**			**No.**	
Vert. Mill	0415	Segment Rack Cam			2	
Operation		**No.**	**Material**		**Date**	**By**
Mill Top		30	MEEHANITE		1/9/51	PLG
Tools or Fixtures		**HSS**	**Cutter**		**Dimen.**	
Clamps, Jack		CARB	FACE		6	
		Depth	**Width**	**Length**	**Approach**	
		1/8	2½	18.0	6.0	

SETUP ELEMENTS	**Base Time**	**Occ.**	**Base Min.**
Job Allowance (Hor. & Vert.)	12.00	1	12.00
Job Allowance (Duplex)			
P. & R. Vise Fixture			
Sq. Jaw to 8″ To 90 sq. in. (Base)			
Cinn. or Swivel To 200 sq. in.			
Large (Hoist) Over 200 (Hoist)			
Angle Plate — Not Alined			
Angle Plate — Alined			
"U" Clamps — Bolts & Blocks	2.65	4	10.60
Stops or Keys — Not Bolted			
Stops or Keys — Bolted			
Jack to Table	1.50	1	1.50
Parallels not Clamped (Pair)			
Parallels Set & Clamped (Pair)			
Rotary Table			
Set Vise or Fixture to Angle			
Layout Piece			
Support or Stop for Long Pieces			
Vertical Attachment			
End Mill, Face Mill "T" Slot	6.10		6.10
Slab Saw, Side Mill			
Straddle Gang			
Interlocking			
Duplex — 2 Cutters			
One Test Cut			1.42
TOTAL BASE MINUTES			31.62
P. F. & D. 15%	**ALLOWED MINUTES (SETUP)**		36.5
R.P.M. 159	**FEED** 16.9″		

type of fixture, the tool and the cut.

By reference to the standard time data, the job change allowance for a horizontal or vertical milling machine is found to be twelve minutes. The elements of these twelve minutes are explained in the Standard Time Data Sheet.

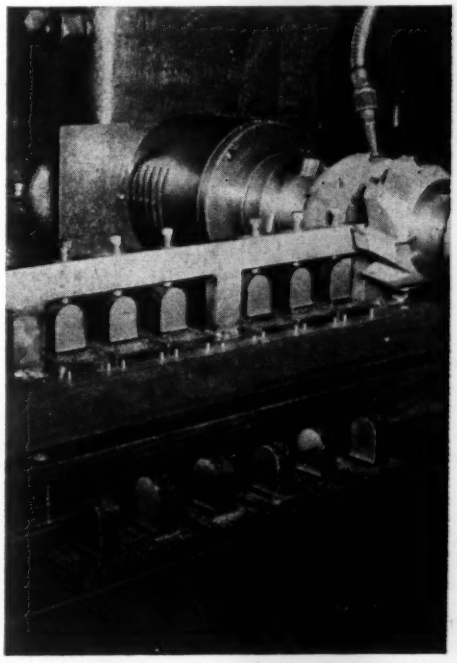
Since this occurs once, it is noted in the proper column and the twelve minutes is entered. The fixture to be used for this operation is a Cincinnati Vise and, since there is one of these, reference to the Standard Time Data Sheet shows that seven minutes are allowed for positioning this Vise.

The 6″ face mill, according to the standard time data, requires an allowance of 6.1 minutes to set. This information is also entered in the proper place on the form.

Each Setup man is allowed the time to take one cut, so that the piece may be taken to the inspector for approval before the job proceeds. The time for this cut is calculated for machining, and allowance is given to the Setup operator for this one cut. The total base minutes, therefore, become 26.04, to which 15% personal, fatigue and delay allowance is added, making a total allowance of 30 minutes for setting up the machine.

A more complicated type of Setup on a similar machine is shown in the picture, Exhibit IV. Since this Setup uses U clamps and a jack, the time allowances

Exhibit VI



in addition to the job allowances are selected from the standard time data sheet and applied to the rate sheet as required. In this case, four U clamps and one jack are required, so that these allowances are given.

The time for the face mill is the same as in the previous illustration — 6.10 minutes. Milling cut requires 1.42 minutes and the total standard time allowed for the Setup of this operation is 36.5 minutes. (Exhibit V)

Exhibit VI shows a photograph of a different type of operation, which is a special fixture for holding six pieces to be milled simultaneously. This operation is done on a duplex mill, which requires a job change allowance of 13.5 minutes, rather than the 12 minutes for a single spindle mill. The special fixture used to hold the six pieces has a base area of less than 200 square inches. Therefore, the time allowance is seven minutes for setting this fixture.

Since two face mills are used to complete the cut, the base allowance of 6.10 is multiplied by two. The time for making the cut is .99 minutes and the total allowed time for setting up the machine is 39 minutes. Standards for the Setup *are* simple. (Exhibit VII)

The whole bugaboo beclouding the issue can be dispelled if the problem is approached in exactly the same manner that any good rate setting problem must be approached. The only difference is that it probably will take a longer time to develop the data.

EXHIBIT VII

RATE SHEET

Machine	**Code**	**Part**		**No.**	
Duplex Mill	0430	Gripper Shaft Center Bearing		3	
Operation		**No.**	**Material**	**Date**	**By**
Mill Sides		40	CI20	1/9/51	PLG
Tools or Fixtures		**HSS**	**Cutter**	**Dimen.**	
Fix-WM 7148-4-1		CARB	SHELL	6	
		Depth	**Width**	**Length**	**Approach**
		1/8	1½	15	6

SETUP ELEMENTS	**Base Time**	**Occ.**	**Base Min.**
Job Allowance (Hor. & Vert.)			
Job Allowance (Duplex)	13.50		13.50
P. & R. Vise Fixture			
Sq. Jaw to 8″ To 90 sq. in. (Base)			
Cinn. or Swivel To 200 sq. in.	7.00		7.00
Large (Hoist) Over 200 (Hoist)			
Angle Plate — Not Alined			
Angle Plate — Alined			
"U" Clamps — Bolts & Blocks			
Stops or Keys — Not Bolted			
Stops or Keys — Bolted			
Jack to Table			
Parallels not Clamped (Pair)			
Parallels Set & Clamped (Pair)			
Rotary Table			
Set Vise or Fixture to Angle			
Layout Piece			
Support or Stop for Long Pieces			
Vertical Attachment			
End Mill, Face Mill "T" Slot	6.10	2	12.20
Slab Saw, Side Mill			
Straddle Gang			
Interlocking			
Duplex — 2 Cutters			.99
One Test Cut			
TOTAL BASE MINUTES			33.69

P. F. & D. 15% **ALLOWED MINUTES (SETUP)** 39.

R. P. M. 287 **FEED** 21.3″

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SOCIETY NEWS

THE TWIN CITIES CHAPTER, in cooperation with the University of Minnesota Industrial Relations Center, is planning the *Ninth Annual Minnesota Industrial Relations Conference* for April 12-13, 1951.

Recognizing the great importance of efficient training procedures in an expanded defense effort, this year's conference will be concerned with the general problem of building effective training programs.

Successful methods of training rank and file employees will be presented by Ernest C. Bartell, Director of training and technical employment, Merck and Co.

Important elements in supervisory training will be discussed by Dr. Otis McCreery, director of training, Aluminum Company of America, and Earl Planty, executive counselor, Johnson & Johnson.

Howard P. Mold, training director, Minneapolis-Honeywell, and Dr. Carroll L. Shartle, Personnel Research Board, Ohio State University, will present various aspects of leadership training.

Measuring the effectiveness of training programs will be discussed by Dr. Raymond A. Katzell, Psychological Services Center, Syracuse University, and Ernest H. Reed, manager of education and training, International Harvester.

Alden Elstrom, President, Alden-Wonderall Co., and Ed Schleh, Personnel Surveys, Inc., will analyze case studies of training programs that have failed.

ROBERT E. WINE has been named coordinator of Sub-contracts by John L. Winchester, director of purchases for the Bendix Radio Division of Bendix Aviation Corp.

THE ST. LOUIS CHAPTER will present The 1951 ADVANCED WORK MEASUREMENT CLINIC at the Chase Hotel, St. Louis, on Thursday and Friday, May 3 and 4.

The Clinic is arranged to provide application problems for the participants. The topics to be covered are: Statistical aids for Time Study, Advanced Analysis for Methods Description, Advanced Procedures for Rating and Demonstration and Pros and Cons of Predetermined Basic-Motion Times. The speakers include those who have been applying these techniques and/or teaching them in their own or other organizations. The speakers will include: Dr. Gerald Nadler, Washington University; Prof. Wallace J. Richardson, Purdue University; George Wanninger, Rice-Stix Co. Guest speakers will be presented at the luncheons.

For further information and details, write to the St. Louis Chapter, S.A.M., P.O. Box 4033, St. Louis 21, Mo.

E. W. JOCHIM, general manager of Chicago operations of Personal Products Corporation, was elected to the board of directors, George H. Murphy, president, announced here today. Mr. Jochim is a Past President and National Director of the Chicago Chapter of SAM.

He joined Personal Products as plant manager late in 1944 from the gas mask division of Johnson & Johnson, but served as adviser to the latter organization until the end of the war.

Following his graduation from University of Illinois and Illinois Institute of Technology, Mr. Jochim successively was: draftsman, design engineer, sales manager, production foreman, production manager, plant engineer, assistant works manager, consulting management engineer, plant manager, and general manager for such companies as: U. S. Gypsum, Marine Supply & Engine Company, Mills Industries, National Metal Trades Association and Johnson & Johnson.

THE WILMINGTON CHAPTER reports the completion of one of the most successful projects ever undertaken by a round table group in S.A.M. The Harvard Graduate School of Business Cases have been studied, and every member of the panel is so very enthusiastic about the results that he is enrolling in the new group to continue the project next year.

The Chairman was George Campbell, who inspired panel members to make the project an outstanding feature of the Chapter's activities.

Membership was limited to fifteen persons with managerial posts in varied Wilmington industries. Selection was limited to men who would assure 100% attendance, and at least eight hours preparation for every session. Members paid $8 and Non-Members paid $10 for the privilege of attending the Round Table.

Formalized procedures were followed with the Chairmanship rotating according to the topic under consideration. Minutes kept by a permanent secretary were reviewed at the end of each session, then later transcribed and distributed to all panel members after each of the eight sessions. Cases on cost control, production and production control, wage incentive systems and human relations were studied.

Interest and enthusiasm has assured the Chapter of two new round tables for next year and a continuation round table

(*Continued on Page* 25)

Los Angeles Chapter "Work Measurement Clinic" draws over 200 participants in two day session, Jan. 30-31.

The Management Bookshelf

How to Chart Timestudy Data, by PHIL CARROLL, McGraw-Hill Book Co., New York, 1950, pp. 323, $5.00

PHIL CARROLL'S "How to Chart Timestudy Data" is a very worthwile addition to an industrial engineering library. Mr. Carroll's purpose in writing the book was to explain in simple terms the techniques he has developed over the years in the presentation and analysis of timestudy data. Books on nomography and the charting of statistics are notoriously dry and abstract, but Mr. Carroll has succeeded admirably in presenting the subject in an interesting and easy-to-read style.

The author develops his charting techniques in gradual stages, going from simple graphs to complex nomographs and multi-variable charts. Mr. Carroll's step-by-step descriptions and copious illustrations should be extremely helpful to the timestudy trainee who is anxious to improve his timestudy "know-how". On the other hand, the book should serve as an excellent reference manual for the experienced practicing industrial engineer who occasionally may be required to solve problems involving more than the run-of-the-mill knowledge of graphical presentation.

In our complex industrial era some of management's most difficult problems center about the exchange of ideas within the corporate organization and the maintenance of an adequate flow of information from management to employees, stockholders, and the general public. The value of graphical presentation as a means of conveying ideas has been recently gaining increasing recognition, and Mr. Carroll's book should therefore also have considerable appeal to the industrial executive who is anxious to improve his understanding of graphical methods.

The Chapters on the standard data method should prove very stimulating to timestudy engineers who have not as yet taken advantage of the numerous benefits that accrue from the standard data method. Mr. Carroll emphasizes the importance of improving methods in the Standards Department as well as in other departments of the company, and he offers many helpful ideas for reducing "the cost per standard". Throughout the book the author presents a number of valuable suggestions for setting standards more economically and for "getting more out of your timestudy dollar".

Phil Carroll is no mere theorist for he has been a very successful practicing industrial engineer and consultant for many years. An outstanding authority on timestudy and wage incentives, he has made many notable contributions to the science of industrial engineering. "How to Chart Timestudy Data" measures up well to his previous contributions to industrial engineering literature.

Harry V. May
Asst. Plant Manager
Fabricating Division
Bridgeport Brass Co.
Bridgeport, Connecticut

CORRECTION

In our January 1951 article on "Outstanding Management Books of the Year" the volume by Maynard, Stegemerten and Schwab should have been correctly described as "METHODS-TIME MEASUREMENT".

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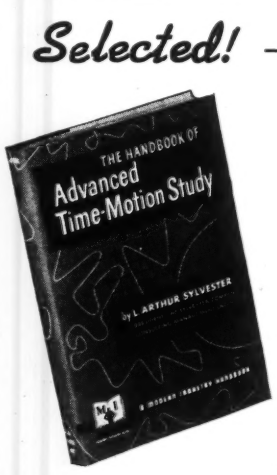

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SOCIETY NEWS

(Continued from page 23)

by this year's group. Membership in the Chapter has increased and the treasury has realized substantial financial gain from round table profits. Preparation and participation are the most important requisites for an outstanding round table such as the one held by the Wilmington Chapter. S.A.M. is ideally designed to provide the organization for constructive activities and round tables of the Harvard Case Studies for Chapters throughout the country.

Note: Sets of Harvard Cases can be secured directly from the National S.A.M. office for Round Table studies.

THE COLLEGE OF ENGINEERING, State University of Iowa, announces the twelfth Summer Management Course to be held June 11 through June 23, 1951, in Iowa City.

It is an intensive course for factory managers, foremen, industrial engineers, methods and time study analysts, cost accountants and office executives.

The areas of Production Planning, Job Evaluation, Motion and Time Study, Wage Incentives, Plant Layout, Quality Control, Supervisory Training, Labor Relations and Legislation, Organization and Policy and Public Speaking are included.

The regular State University of Iowa teaching staff will be augmented by outstanding men from a variety of industries and other educational institutions.

For details write J. Wayne Deegan, 122 Engineering Building, State University of Iowa, Iowa City, Iowa.

WEST VIRGINIA UNIVERSITY's Industrial Engineering Option is sponsoring the Second Industrial Engineering Conference to be held in Morgantown, W. Va., on May 3rd and 4th.

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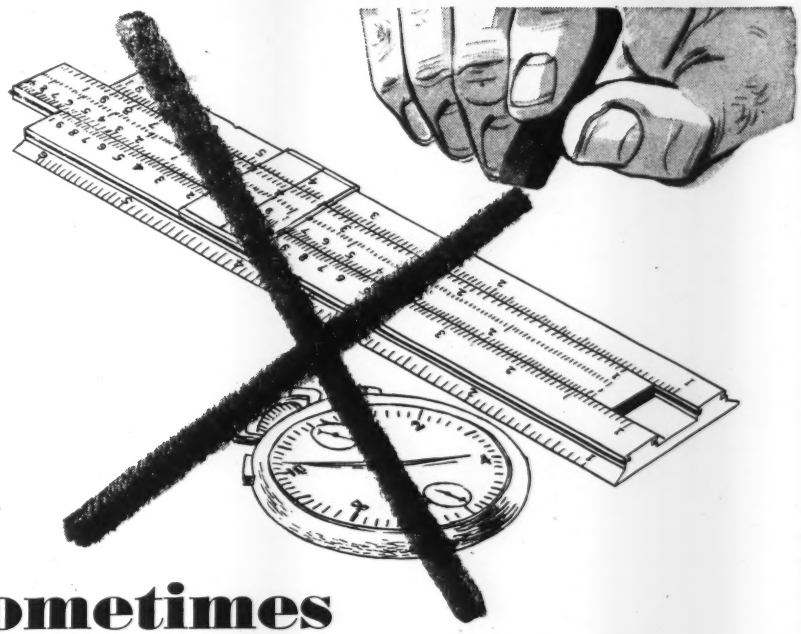

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Session 1. "How to organize and operate an Industrial Engineering Department"
W. Gilbert Brooks, Chief Industrial Engineer
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Session 2. "How to meet the Industrial Engineering manpower shortage"
P. Kay Schwartz, Vice President,
Proctor & Schwartz, Inc.

Luncheon Session
"Selling Industrial Engineering"
H. B. Maynard, President
Methods Engineering Council

THURSDAY AFTERNOON

IMPROVING THE TOOLS

Session 1. "How to chart Time Study data"
Phil Carroll, author of "How to Chart Time Study Data"
Professional Engineer

Session 2. "Improving methods through M.T.M."
Ralph Kirwin, Chief Industrial Engineer
Bulldog Electric Products Company

Session 3. "Improving the Time Study Rating Process"
Samuel M. Dix, Industrial Engineer
General Foods Corporation

Dinner Session
"Productivity—The Key to National Security"
Dr. Harold G. Moulton, President
The Brookings Institution

FRIDAY MORNING, APRIL 20th

BETTER METHODS MEAN MORE MANPOWER

Session 1. "Incentives for Indirect Labor"
George Dlesk, Chief Industrial Engineer
American Box Board Company

Session 2. "Measuring Multiple Machine Interference"
Dale Jones, Assistant Professor,
Industrial Engineering, Georgia Institute of Technology

Session 3. "Tailoring the Incentive Plan"
Paul J. MacCutcheon, Chief Industrial Engineer,
Peter Cailler Kohler Swiss Chocolates Co.

Luncheon Session
"Measurement—a Tool for Management Control"
Ralph Presgrave, Vice-President
J. D. Woods & Gordon, Ltd.

FRIDAY AFTERNOON

LET'S WORK WITH A WILL

Session 1. "Time Study Training for Supervision"
J. F. Biggane, Chief Industrial Engineer
Maytag Company

Session 2. "Simplifying the Product Design"
Collier A. Elliott, Director Product and Pkg. Design
Methods Engineering Council

Session 3. "Layout Planning with 3 Dimensional Models"
Robert T. Charlton, Production Engineer
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International Management

(Continued from page 10)

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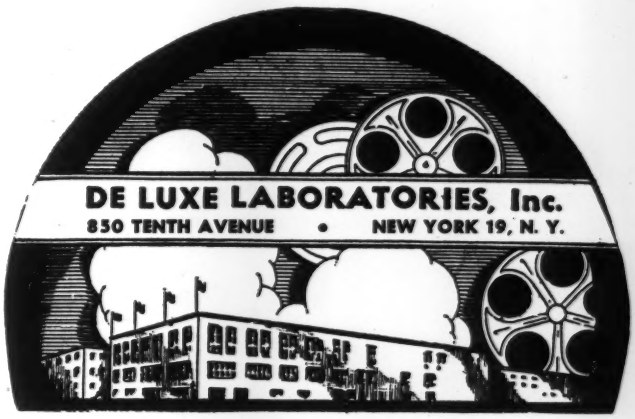

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